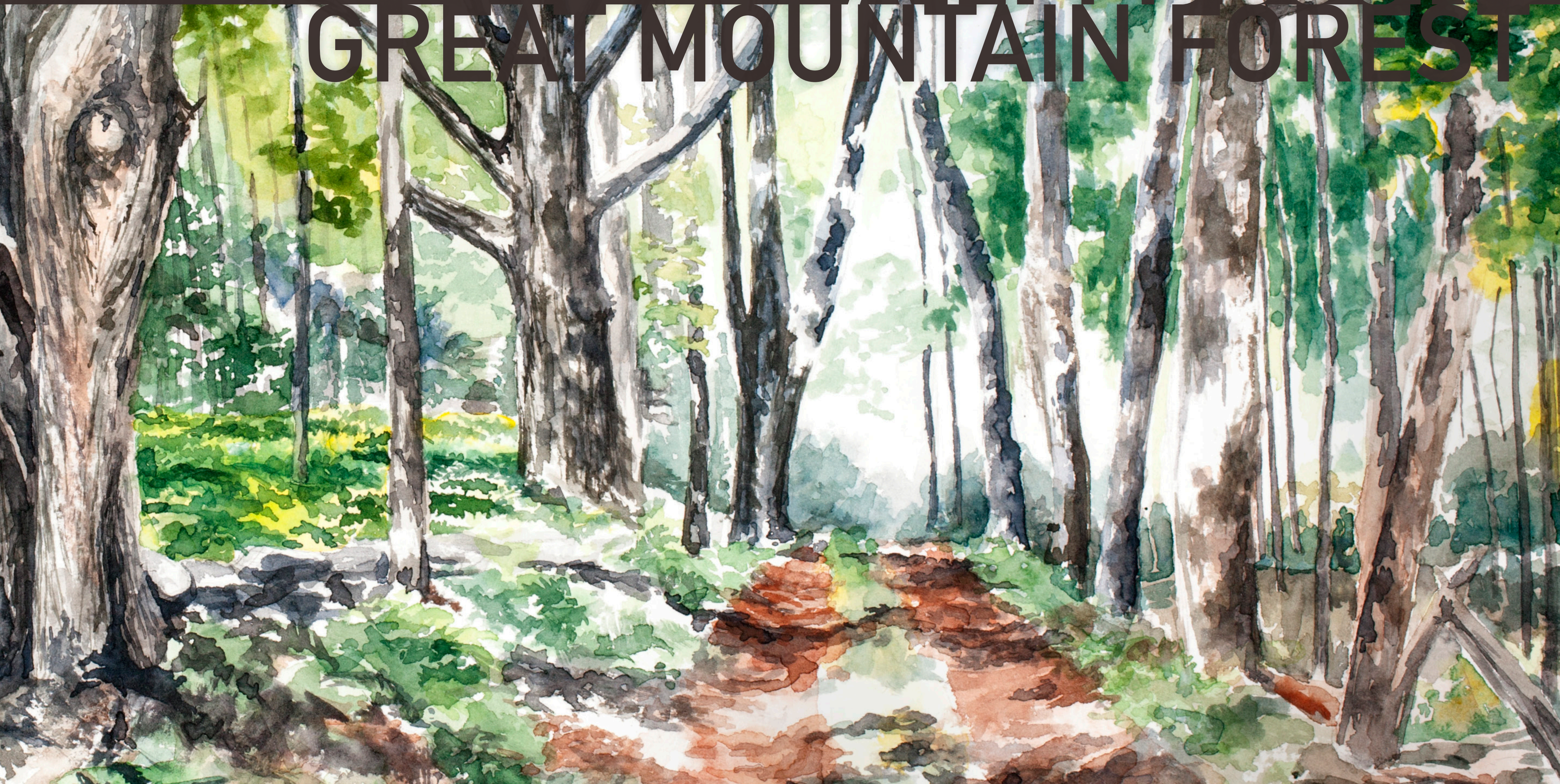
A FIELDBOOK
GREAT MOUNTAIN FOREST



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SITES OF INTEREST: GEOLOGIC AND GEOMORPHIC SITES

Although the thrust of this project lies in the forest, several sites in Great Mountain Forest are noteworthy for their geological and/or geomorphological interest. As discussed in the first section of this book, the biological and cultural landscapes refer back to geology. That is, the distribution of plant communities and thus fauna is driven in large part by geology. Similarly, the cultural landscape and the places and ways people have made habitat from the land is driven largely by geological history.

These sites bring people to the places we identified during our field inventory. Undoubtedly, additional significant sites exist, waiting to be discovered and interpreted. The sites span the very simple (bedrock sites) to the more complex (Glacial Lake Norfolk). Use these as a launching point for understanding geology and uncovering the ways rocks and landforms drive our ecosystems and our history.

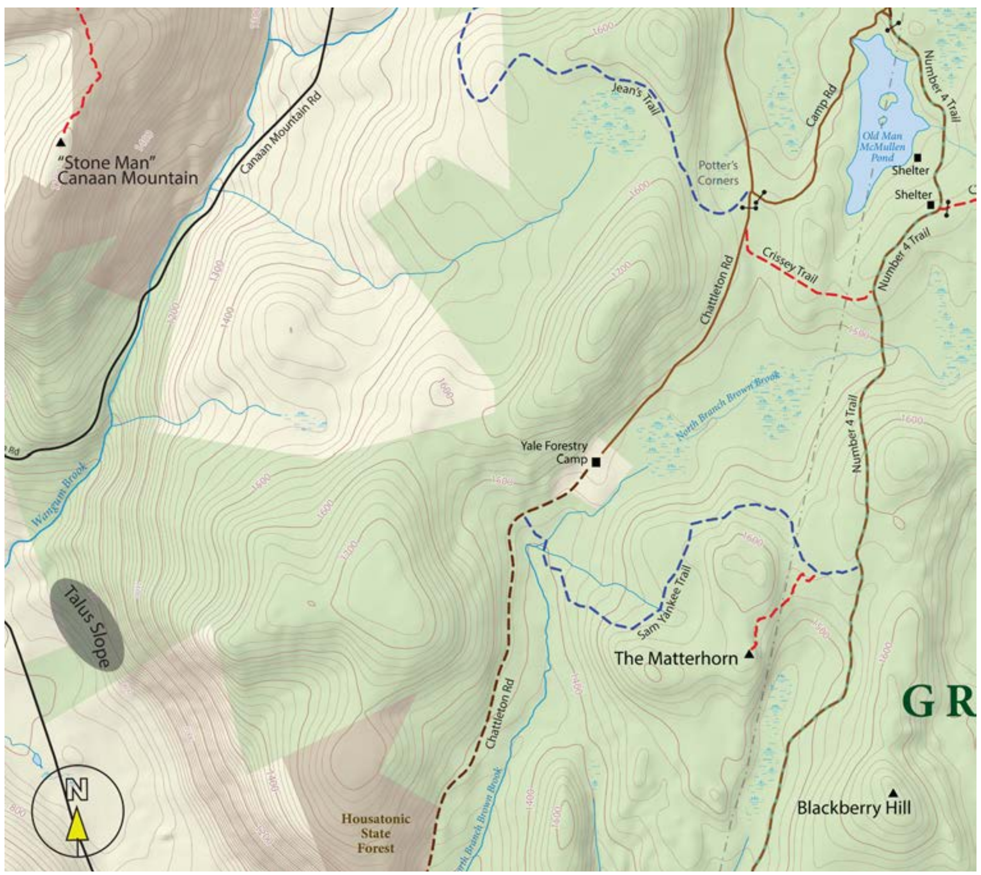
PHYSICAL LANDSCAPE 1: BEDROCK

Summary

In some landscapes bedrock can be difficult to find. Deep soils and vegetation obscures the geologic story. But at Great Mountain Forest, bedrock is common, accessible and observable. These bedrock exposures show not only the specific rock type, but also the glacial history through weathered polish.

Access

See specific sites below.



Locator map for bedrock sites listed at left. Numbers (1-4) refer to specific listed locations.

Specific Location

1. *The Matterhorn*: 41°56'33.89"N; 73°15'20.82"W

2. *Stoneman Summit*: 41°57'27.20"N; 73°16'57.43"W

3. *Blackberry Hill*: 41°56'16.06"N; 73°14'59.65"W

4. *Talus Slope*: 41°56'33.69"N; 73°16'52.74"W

Comparative or nearby sites

See Rocky Outcrop balds in Natural Communities.
Stoneman: See Stoneman Summit in this section.
Blackberry Hill: See Oak-Hickory Woodland in Natural Communities.
Talus Slope: See Rich Talus Slope in Natural Communities

Description

The sites listed here suggest a few of the many places in GMF where bedrock is exposed. These sites display extensive areas of exposed bedrock. But walking in the woods and especially on the ridges, bedrock

Bedrock section of Canaan Mountain Schist on the Matterhorn at GMF.

occurs frequently. Glacial polish, now 16,000 years weathered, occurs and demonstrates that aspect of GMF's story. The Talus Slope does not contain actual bedrock, but very large boulders including a few slabs of Stockbridge Marble. See also the Appalachian Forest site in Natural Communities for an additional marble boulder. Marble exposures are rare in GMF.

Visible Layers Include:

- •Upper and lower slice of Canaan Mountain Schist (highest layers; most of GMF)
- •Large blocks of Stockbridge Marble or Walloomsuc Schist (lowest layers)
- •Gneiss of the Housatonic Massif (should be visible in the far south of GMF).

Importance

Bedrock geology sets the foundation for the biological and the cultural landscapes. Though GMF generally has low geological diversity, a few different rocks types can be found. See the Geological Underpinnings section above for GMF geology.

Research Questions

How does the presence of bedrock (shallow soils) shape plant communities? How does primary succession differ in various bedrock environments?

Resources

See resources in section 1 for Geologic Foundations.

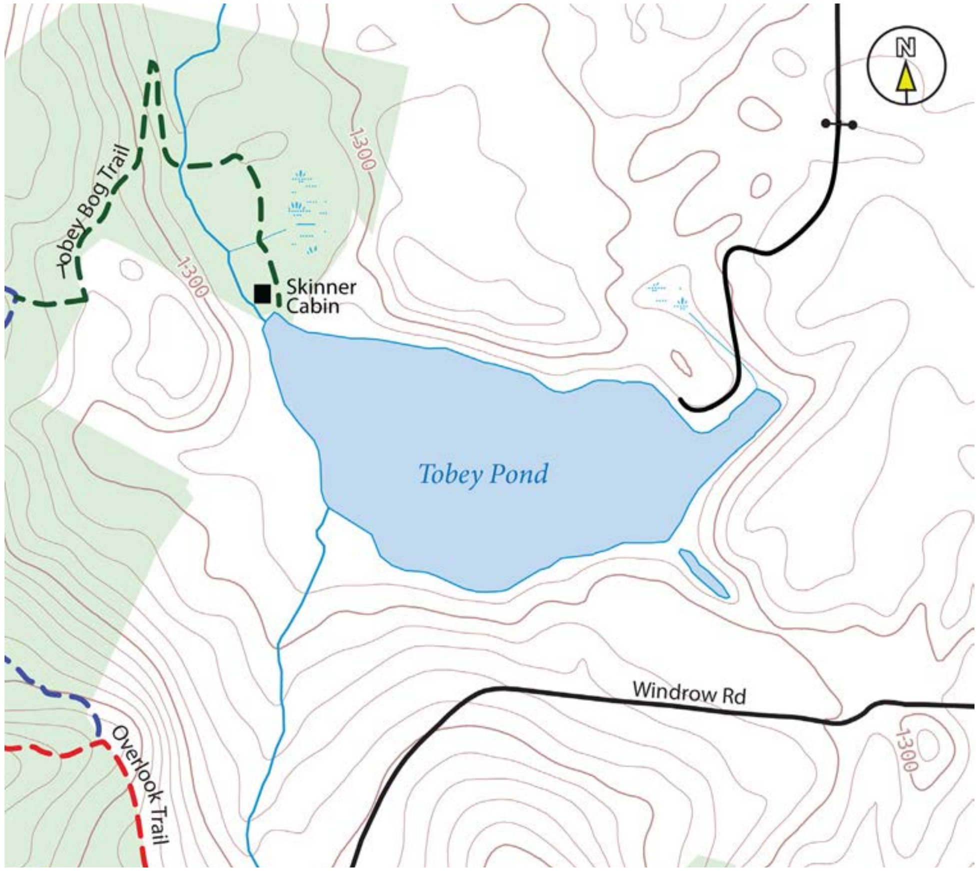
PHYSICAL LANDSCAPE 2: GLACIAL LAKE NORFOLK

Summary

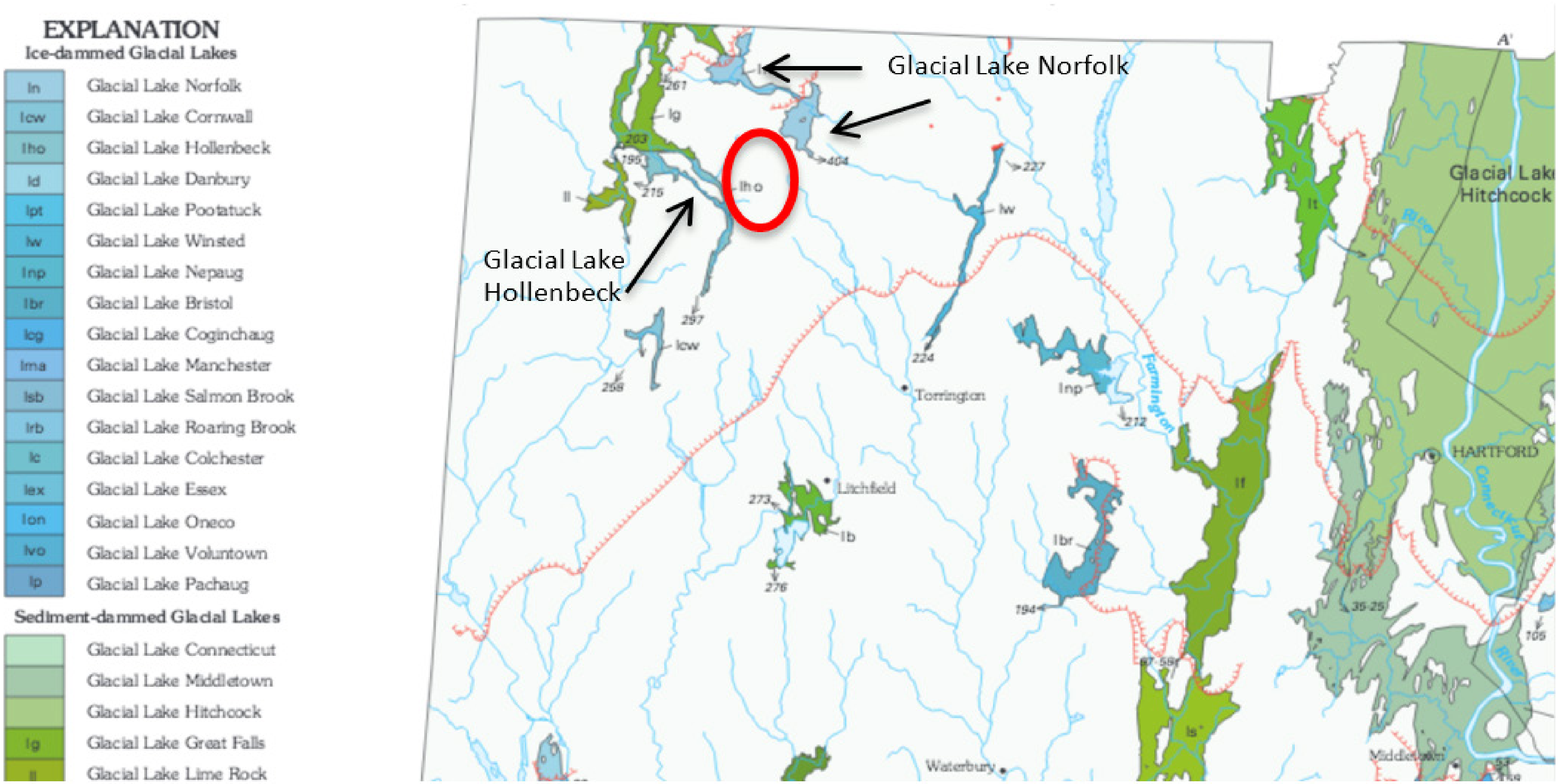
The site contains glacial deposition features in the area of postglacial Lake Norfolk. Toby Pond, Toby Bog, and kettle, kame, and moraine glacial deposits around the old Norfolk Downs golf course comprise areas of significant glacial deposition in/near GMF.

Access

Access from Tobey Pond. Some areas are not identified as GMF lands on maps. Inquire at GMF Office.



Location of Glacial Lake Norfolk as described here. For map of glacial features see next page.



Map of glacial lakes in Connecticut by Stone et al. (2005) here cropped to show only NW Conn. Great Mountain Forest approximately shown with red circle. Ice margin (dam) in red shown for Lake Norfolk.

Specific Location

1. *Tobey Pond*: 41°58'34.10"N; 73°13'04.10"W: Town beech.

2. *Tobey Bog*: 41°58'42.20"N; 73°13'32.14"W: Ice margin deposit occurs opposite the road from trail entering the bog.

3. *Norfolk Downs*: 41°58'43.14"N; 73°13'5.77"W: this point occurs on the crest of an ice margin deposit shown as red line in the map above.

Comparative or Nearby Sites

The Norfolk Downs golf course, in the land use history section, details its history. Tobey Bog is described in the Natural Communities section.

Description

Approximately 15,500 years ago, the basin that is today Norfolk Village was an ice-dammed glacial lake. Its presence was likely fleeting, lasting only from when ice melted in the basin until the ice dam to the north collapsed. Nonetheless, it was long enough to deposit sorted lacustrine

Glacial geology map from USGS. Light blue area in center-right is GlacialLake Norfolk. Tobey Bog is slightly northwest of the pond. Red lines with ticks show ice margin positions from the outer edge of the glacier. The landscape to the north and east of Toby Pond is undulating glacial sediment with kames, kettles, and ice margin deposits. The black arrows show direction of glacial travel. See Geological Underpinnings for description of surficial geology.

sediment, ice margin deposits, and shape the land.

Without a close examination of the soils and sediments of the area, a complete description is hypothetical. Warren (1969) described the site in some detail. Nonetheless, it is clear walking this area, with short steep ridges and undulating topography, that significant glacial and lacustrine deposition has occurred.

Glacial Lake Norfolk formed as the ice retreated, dammed to the north by the ice itself (Ice margin) and to the south by the watershed divide. It can be seen on the USGS map above. In this area small tributary streams of the Blackberry River flow north, opposite direction of that of the ice. The streams flowed north, bringing sediment from deposits in the recently deglaciated landscape. The glacial deposits are composed of sands, pebbles and gravels. Tobey Pond Delta formed from the input of these riverine sediments into Glacial Lake Norfolk. The sediments buried a chunk of ice on the margin of the lake, and when that melted, Tobey Pond Kettle was formed.

The undulating kettle and kame deposits of the Norfolk Downs area north of Tobey Pond. It's unclear whether the rock in the photo is bedrock or a very large deposit (bedrock likely of marble).

A kettle pond forms during glacial retreat when a chunk of ice is buried under sediment, often in a delta (which occurred in the south end of Glacial Lake Norfolk). When the buried ice finally melts, a depression is left. If the local water table is high enough, a pond forms. Or if the local water table is marginal a wetland, like Tobey Bog, forms. To the north of Tobey Pond, additional kettles occur, but the water table is too low for these to be ponds (or bogs). Instead, they are simply pine-filled depressions in the old Norfolk Downs gold course. Pine prospers on well-drained and excessively drained soils. The abandoned Norfolk Downs golf course (today covered in ~50-year old white pine) in particular contains glacial deposition.

A few areas of bedrock appear, and these should be Stockbridge Marble showing through the Norfolk Window, but this was not confirmed on the ground. The sediments are deep; a test well near the town beech was drilled 113 feet, almost entirely through sand, without reaching bedrock. If all the sand were removed, the site would contain an interesting topography of chasms over 100 feet deep.

Tobey Bog near Tobey Pond. The bog is a depression among the glacial lake Norfolk delta deposit. It is a kettle, like Tobey Pond, formed from a buriedchunk of ice that later melted. Today it holds black spruce, perhaps thesouthern-most stand in New England.

Warren (1969) suggests Glacial Lake Norfolk ended in a sudden burst and draining when the ice dam collapsed. Such events can be catastrophic and landscape shaping.

Importance

This is the best, and really the only, extensive glacial deposition site in and/or adjacent to GMF. The site needs additional mapping, research and interpretation to sort out its remarkable story. That it is topped off with Tobey Bog and the North 40 Old Growth makes the area all the more interesting. An entire day could be spent here looking at glacial features, the bog, old growth, and the human land use legacy that formed as a result of the site's remarkable glacial history. Arguably, Norfolk history is directly tied to its ancestral glacial lake.

Research Questions

Where are the ice margin deposits? Build a detailed map of the site's bedrock, kames, kettles, and moraines.

How has substrate type shaped succession on the Norfolk Downs golf course?

How has Glacial Lake Norfolk driven the history of the Norfolk Village?

Resources

Stone, Janet, et al. 2005. Quaternary geologic map of Connecticut and Lond Island Sound basin. United States Geological Survey and Connecticut Department of Environmental Protection, Geological and Natural History Survey. http://pubs.usgs.gov/sim/2005/2784/

Warren, Charles. 1969. Glacial Lake Norfolk and drainage changes near Norfolk, Connecticut. In: United States Geological Survey (USGS) 1969 Chapter D: Geological Survey Professional Paper 650-D.

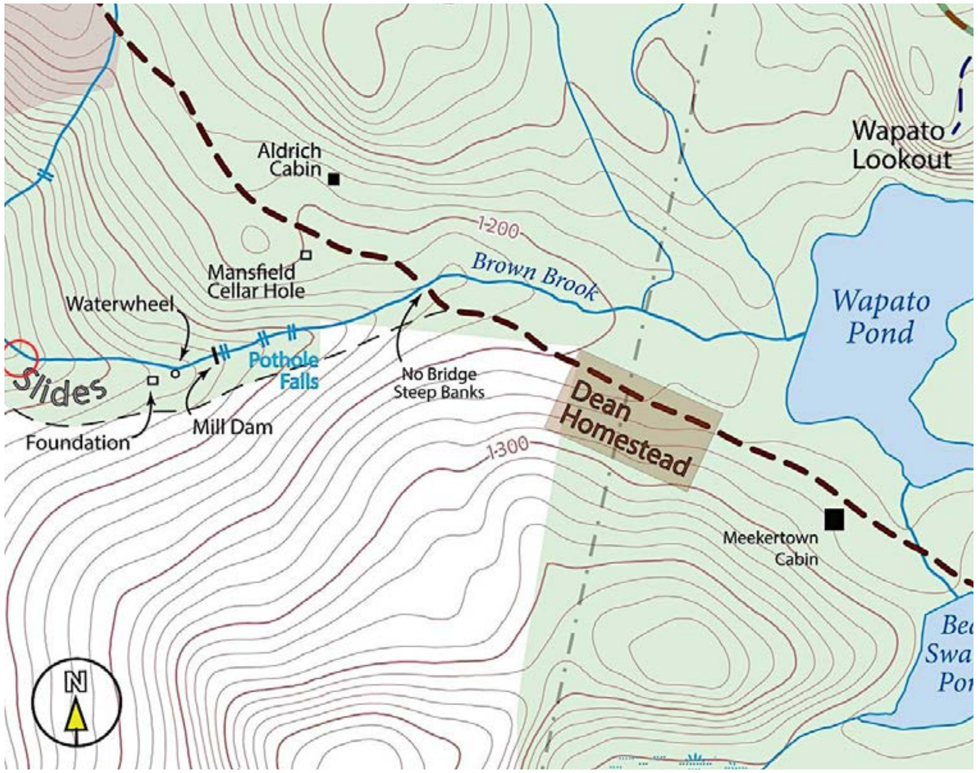
PHYSICAL LANDSCAPE 3: SLIDE AREAS ON BROWN BROOK

Summary
The site contains two mass-wasting slides along Brown Brook. Geological processes continue today.

Access
Best access is to hike down from Meekertown Road following Brown Brook.

Specific Location
41°55'43.91"N; 73°16'8.84"W

Comparative or Nearby Sites
Just upstream is the Mansfield Sawmill.
A number of collier hearths occur in the area.



Location of slide areas on Brown Brook. Slides are located on south side of the stream at the bend.

One of the slide areas in the lower portion of Brown Brook. Such geomorphic sites are rare in GMF and forested New England in general.

Description
This site contains two mass wasting (land slides) events. Their size was not measured, but is estimated at 20 meters in vertical height and 10 meters wide each. Together, they might total half an acre of open sand and gravel slope. It's unclear when these occurred, but likely it was during a large rain event. Quite possibly it was Tropical Storm Irene in 2012. Dating the site should be possible either in the field or by remote sensing.

Importance
Because geological processes occur over vast spans of time, they are difficult to observe. But here we see geomorphology in action. No other wasting site is known in GMF.

Research Questions
Slope stability?
Successional processes on an eroding slope?
Sediment origin (glacial deposit, fluvial deposit, or something else?

PHYSICAL LANDSCAPE 4: TALUS AND GLACIAL LAKE HOLLENBACK

Summary

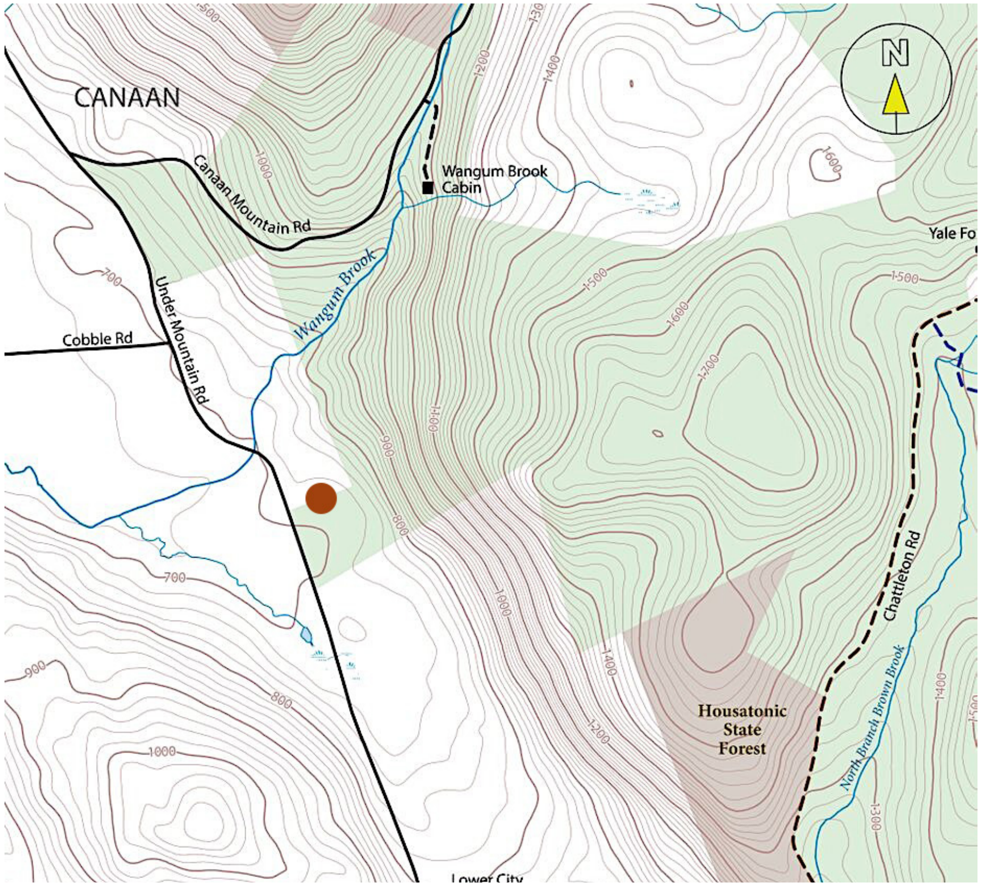
The sites display a large-block talus slope at the margin of Glacial Lake Hollenbeck.

Access

Access is via Under Mountain Road 0.7 miles south of Canaan Mountain Road.

Specific Location

Talus slope: 41°56'33.69"N; 73°16'52.74"W



Location for Glacial Lake Hollenbeck and the Talus slope. Chestnut Orchard is marked for parking and access to talus.

Comparative or nearby sites

A second talus slope occurs at the Appalachian Forest site described in the Natural Communities section. That area contains at least one large chunk of Stockbridge Marble. It's a larger, steeper slope than the one here.

This is also the site of the Rich Talus Slope described in the Natural Communities section. An example of geology driving communities and human land use.

The Chestnut plantation occurs at this site.

Glacial Lake Norfolk is described in this section.

Description

This site contains two somewhat unrelated features. First is the talus slope containing blocks of both Canaan Mountain Schist and Stockbridge Marble. The sizes of the boulders are impressive. Bedrock continues up the slope.

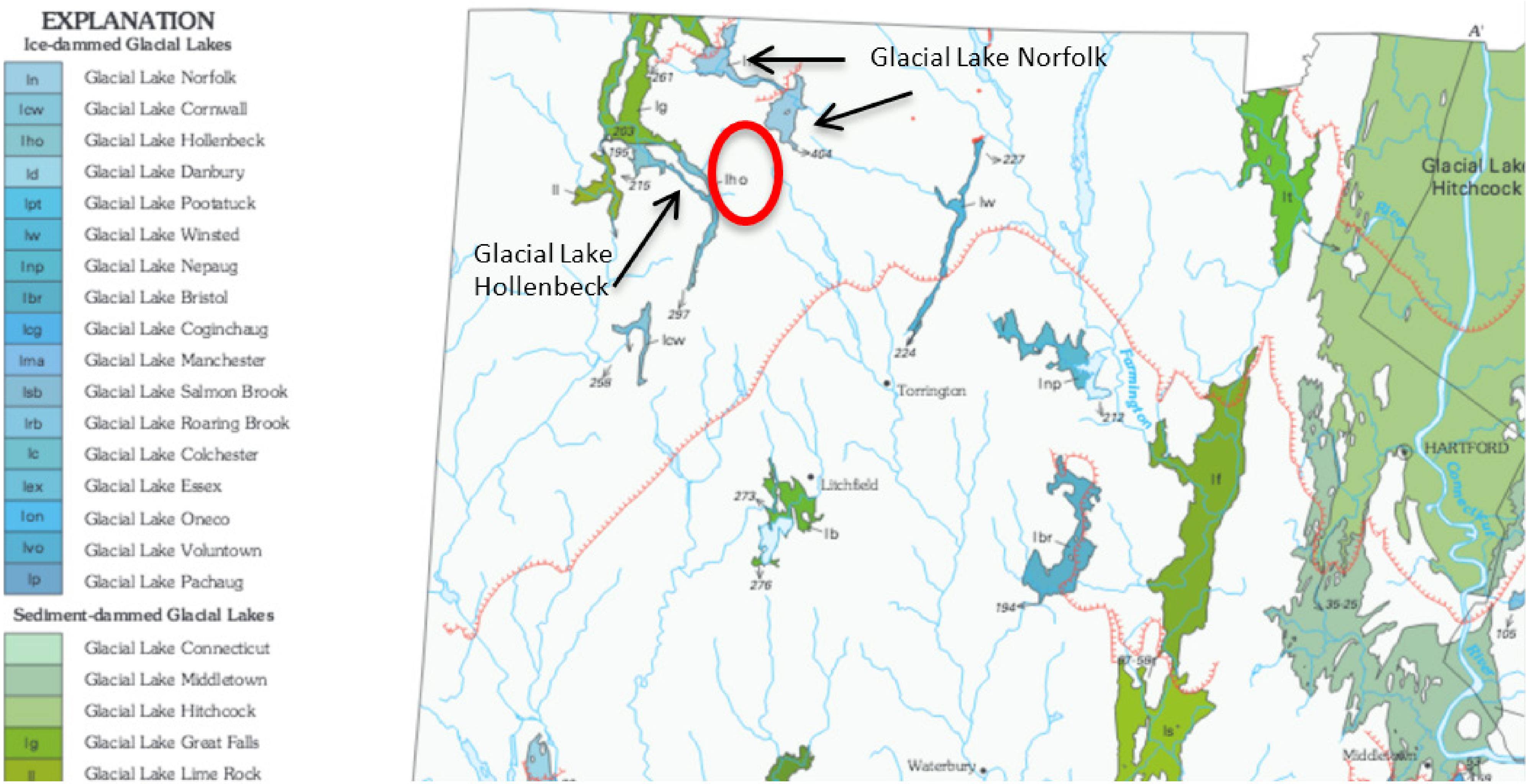
The second feature is Glacial Lake Hollenbeck. There is little to observe here beyond the valley and the fine sediments of the valley soil (in stark contrast to the talus slope). But a map (right) and imagination can make the glacial history of this west side of GMF more impressive. Glacial Lake Hollenbeck was an ice-dammed glacial lake on the north flowing Hollenbeck River and up Wangum Brook. Glacial Lake Great Falls, a sediment dammed lake, occurred later (when the ice dam of Hollenbeck melted) and today forms Robbins Swamp. See map.

Importance

Large block talus slopes are common in Great Mountain Forest. Most of these occur on the plateau and on steep, often south-facing slopes (see Roche Moutenee entry). Glacial Lakes are rare; there is little so observe here beyond the imagination.

Resources

Stone, Janet, et al. 2005. Quaternary geologic map of Connecticut and Lond Island Sound basin. United States Geological Survey and Connecticut Department of Environmental Protection, Geological and Natural History Survey. http://pubs.usgs.gov/sim/2005/2784/ConnSheet2.pdf



Map of glacial lakes in Connecticut by Stone et al. (2005) here cropped to show only NW Conn. Great Mountain Forest approximately shown with red circle. Ice margin (dam) in red shown for Lake Norfolk.

Photographs

See Rich Talus Slope section in Natural Communities and Chestnut Plantation.

PHYSICAL LANDSCAPE 5: ROCHE MOUTONÉE

Summary

A Roche Moutonnée is a glacial erosional feature common in New England. Great Mountain Forest contains several. Here four sites are shown in close proximity in the southern reach of GMF.

Road Access

Wapato Overlook on the Number Four Trail. Meekertown Road near the Number Four Trail (see map right). Crissey Pond Overlook (not shown or described here).

Specific Location

Wapato Overlook Parking: 41°56'0.25"N; 73°15'11.52"W
See map right for additional locations.

Comparative or Nearby Sites

See Rocky Outcrop Communities in Natural Communities section.

Description

A roche moutonnée is a glacial erosional feature created by thick glacial ice moving over a hilly or mountainous landscape. In this case, the south-flowing ice shaped gentle slopes on the north side of hills. Once the ice reached the peak, the change to downward pressure plucked large blocks of rock from the south side. This creates a cliff.

Once the cliff formed, the downward pressure of the ice driving into base level carved a depression where a small lake (called a tarn) develops. In GMF, these lakes had in-filled to become wetlands by historical times, but for a few millennia after the ice melted 15,500 years ago, they would have been small lakes. The wetlands were dammed in historic times and their surface level increased to create new lakes.

Vegetation on the south-facing slopes was not explored extensively or systematically. On the crest, communities of white oak and other dry sited plants occur. Community composition and structure should be examined for potential patterns.

Importance:

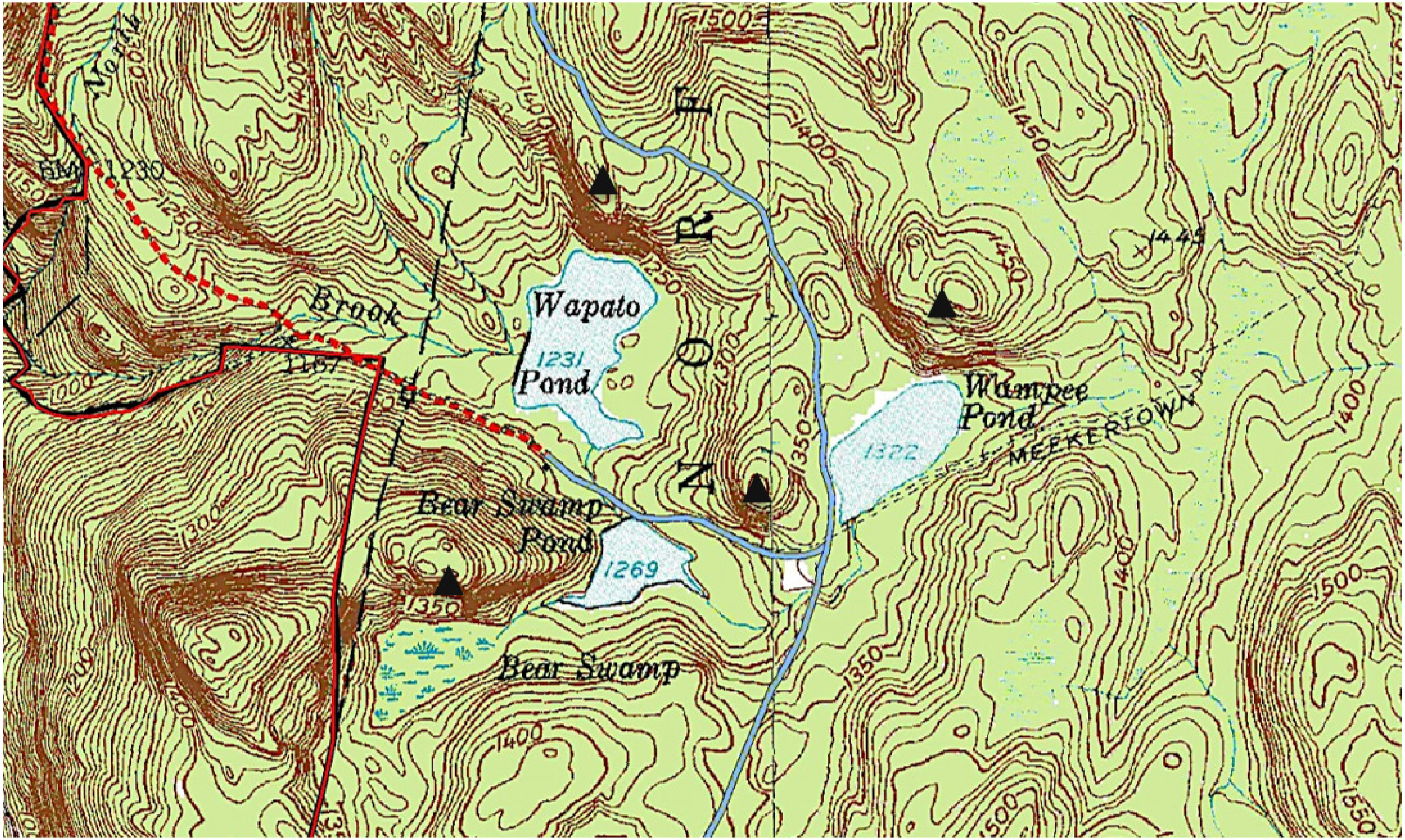
Roche Moutonnées are very common in New England. In GMF the summits and south-facing cliffs create drier, sub xeric communities.

Research Questions

What community types occur on steep south-facing glacially plucked cliffs?
What has been the vegetation development of the wetlands/lakes at the bases of the cliffs? (A palynological study)

Photographs

See photographs in the next site for Crissey Pond roche moutennee overlook.



Four Roche Moutonnées (black triangles) in southern Great Mountain Forest shown here on a USGS topographic map to highlight the steep south-facing slopes. As the ice flowed southward, it shaped gentle slopes on the north side of hills. The south sides were plucked of stones as the ice rode over top. The cliff on the north side of Crissey Pond (not shown) is also a Roche Moutonnée.

PHYSICAL LANDSCAPE 6: NATURAL LAKES

Summary

Many lakes at Great Mountain Forest are human-created, typically by building small dams in formerly swamp or open wetland environments. Some lakes, however, are long-lived natural lakes of glacial origin.

Road Access

See GMF maps for access to ponds.

Specific Location

See maps for locations.

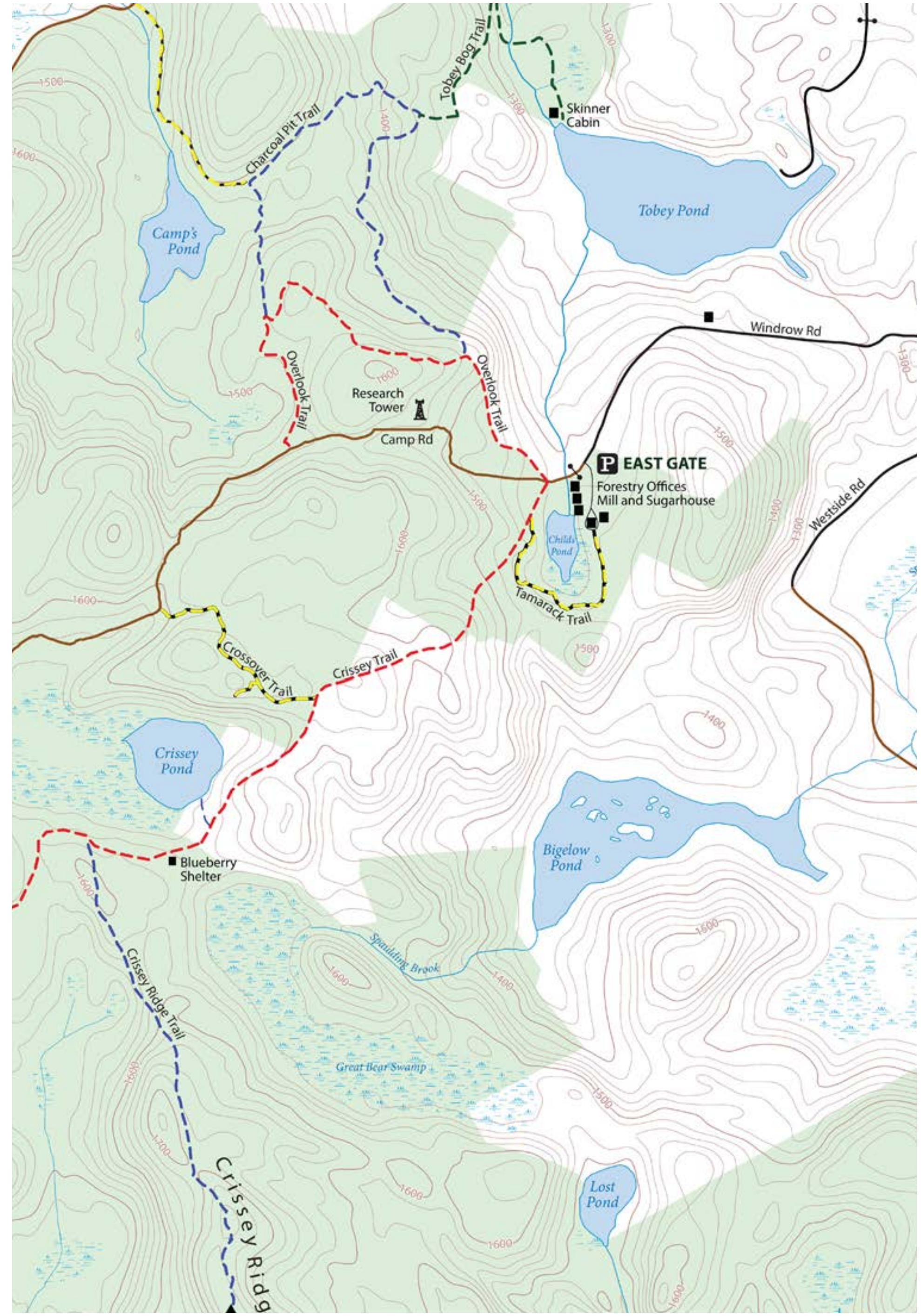
Comparative or nearby sites

None listed.

Description

Determining what lakes have always occurred on Great Mountain Forest and which are human created is not necessarily an easy task. The

Crissey Pond at Great Mountain Forest from the Crissey Pond overlook. Crissey is one of several natural ponds.



Locations of likely natural lakes in GMF. Compare to Fagan's 1853 map.

Fagan's 1853 map of Norfolk shows five GMF ponds: Tobey, Camp, Mud (Crissey), Balcom (Lost), and Bigelow (smaller, unnamed).

presence or absence of a dam hardly provides the full story. For this site description we used Weiner's thesis and the 1853 map (Fagan) to try to uncover which lakes and ponds are natural and which are human created.

It's nonetheless worth noting that even the human ponds such as Wampee and Wapato began as natural lakes after the ice melted 15,500 years ago. It's only been through infilling over the millennia that lakes have progressed to wetlands.

Weiner (1955, p.14) notes:

> The ponds and lakes include six that are naturally of their present size; these are Tobey, Camps, Crissey, Seldom Seen, and Dolphin Ponds and Wangum Lake. McMullen and Bigelow Ponds are natural bodies of water whose extent has been enlarged by damming. Childs, Wampee, Bear Swamp, and Wapato Ponds are wholly artificial in origin, occupying the sites of former swamps.

The map by L. Fagan (1853) shows the following ponds with their 1853 names and contemporary name in parenthesis: Tobey, Unnamed (Camps), Mud (Crissey), Balcom (Lost, aka Dolphin), Wangum Lake, Unnamed (Bigelow, smaller than present), Unnamed (Tannery).

On the 1853 (Fagan) map, only Tobey is showed with a dam. And we know from the glacial history (see previous site) that Tobey is a natural kettle lake. Tannery is showed with a sawmill, so its origin is questionable (and it is off GMF lands).

Each pond might have a slightly different mechanism for formation. For example, while Tobey is a kettle lake (see Glacial Lake Norfolk), Crissey is a tarn crated at the base of a roche moutennee (see roche moutennee). As noted previously, other roche moutennee's had wetlands below them that are now are dammed. Other ponds may be kettles, but the surficial geology maps don't suggest that.

Importance

Natural ponds have value for research. They are also good for the human imagination.

Research Questions

Look through historical documents to uncover when dams were constructed.

Pollen research could determine the postglacial vegetation history at GMF.

Resources

Wiener, H. 1955. History of Great Mountain Forest. Dissertation, Yale University.

Fagan, L. 1853. Map of the Town of Norfolk. Retrieved through Library of Congress: http://www.loc.gov/item/2011589304

Fagan, L. 1853. Map of the Town of Canaan. Retrieved through the Library of Congress: http://www.loc.gov/item/2004626473/

PHYSICAL LANDSCAPE 7: IRON TRAIL AND STONEMAN SUMMIT

Summary

The Iron Trail's legacy traces back to the days of the iron industry, where it served as a highway linking colliers and forges. Today it is still active as one of the most beautiful hikes at GMF, replete with the legacies of geologic and human activity. It is also a great site to see rocky outcrop lichen and moss communities at their most vibrant (see Natural Communities 4)

Access

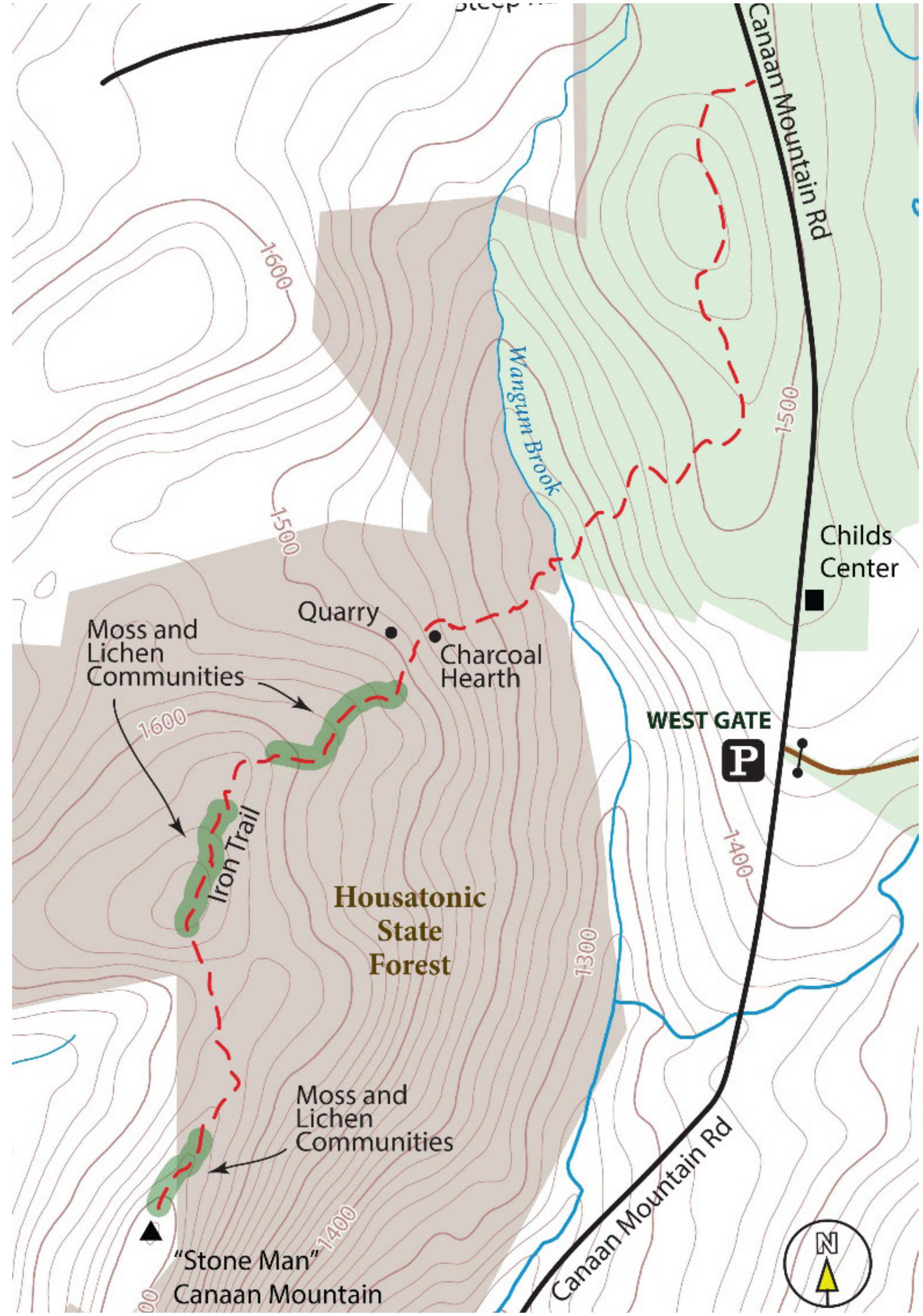
Visitors may park at the Childs Center, then walk 5 minutes up Canaan Mountain Road to the head of the trail. By the Spring of 2016, there should be a parking area at the trailhead, which now has a kiosk.

Location

Iron Trail Trailhead:
41°58'16.20" N; 73°16'19.22" W

Quarry:
41°57'53.68" N; 73°16'42.26" W

View of Wangum Lake from the Stone Man Summit.



Iron Trail Trailhead: 41°58'16.20" N; 73°16'19.22" W
Quarry: 41°57'53.68" N; 73°16'42.26" W

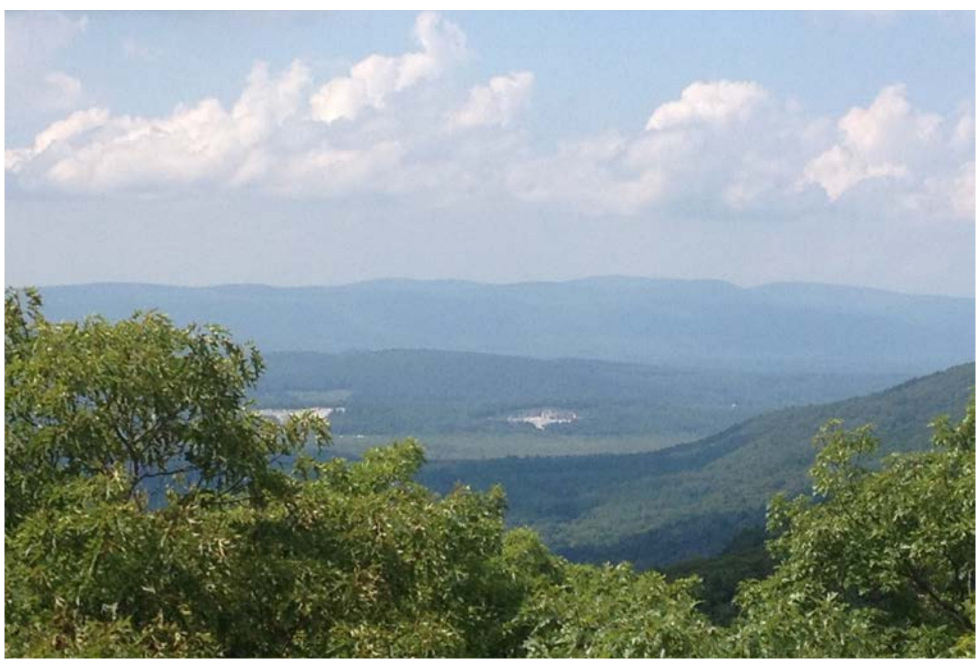
Nearby or Comparable Sites

The trailhead is across the street from the Mergen Pinetum (Research Sites 4), the Pitch Pine Study plantation (Research Sites 5) and the New England Cottontail Habitat (Forest Management 10).

Description

The Iron Trail that leads the way up Canaan Mountain to the Stoneman Summit was once the major thoroughfare for transporting charcoal produced in the forest to the Beckley blast furnace in North Canaan. Colliers made the ascent in both directions with their carts, up until the last gasps of the furnace in 1919. The surrounding hemlock-dominated forest entered the charcoaling cycle at a very early date, and shows much evidence of this legacy. There is a distinct charcoal hearth on the left side of the trail, just before the path becomes considerably steeper. The abundance of multi-trunked hardwoods surrounding it suggest an intensive rotation of coppice cutting.

Farther up the trail, there is an old granite quarry, evidenced by smooth downward cuts in the stone face next to the trail. Such rocks did not have a direct purpose in the iron working process, but were likely rather used for sturdy house foundations in the surrounding towns and villages.



View of the Conklin limestone quarry in North Canaan.

Edge of the granite quarry on the Iron Trail. Stone workers once chiseled slabs from the ground for use in masonry projects.

The Stone Man: past and present.

The Great Mountain Forest summer crew.

The path weaves up through dense hemlock forest and emerges onto an open bald ecosystem (see Natural Communities 4: Balds and Rocky Outcrops). For the most part, only occasional small stunted trees (mostly pines) provide any semblance of canopy cover. Two small areas serve as exceptions: flat areas abutting ascending rock ledges where old communities of oak and hemlock form thick shady mixtures once more. We were unsure how to explain this phenomena. It could be that soil collected more deeply in these pockets due to some quirk of the winds or the ancient glacier's path. Alternatively, it could be that the topographic arrangement somehow offers the sites some protection against the spread of fire, which was a frequent occurrence in the days of collier activity. Safe in their fire refugia, trees can grow taller and advance to a later climactic stage than the surrounding environment.

The current day Iron Trail terminates at an artful pile of rocks known as the "Stone Man". From the summit, one can see Wangum Lake to the northeast, surrounded by the Housatonic State Forest that lies adjacent to GMF. From the right vantage point, one can also see the Mountain House on Canaan Mountain Road (more easily once the leaves have fallen). Looking southwest, the old North Canaan limestone quarry is clearly visible in the distance. As with so many features at GMF, the chance occurrence of the underlying geology had great influence on the shaping of the landscape. As described in the Human History section, limestone is a key component in the iron forging process, and its abundance in the region enabled the industry to flourish—prompting the land clearing and fires that influence the canopy communities in GMF to this day.

Resources

Carlson, Hans 2015. A walk up Stoneman. Norfolk Now online: http://www.nornow.org/2015/07/01/its-only-natural-a-walk-up-stoneman/

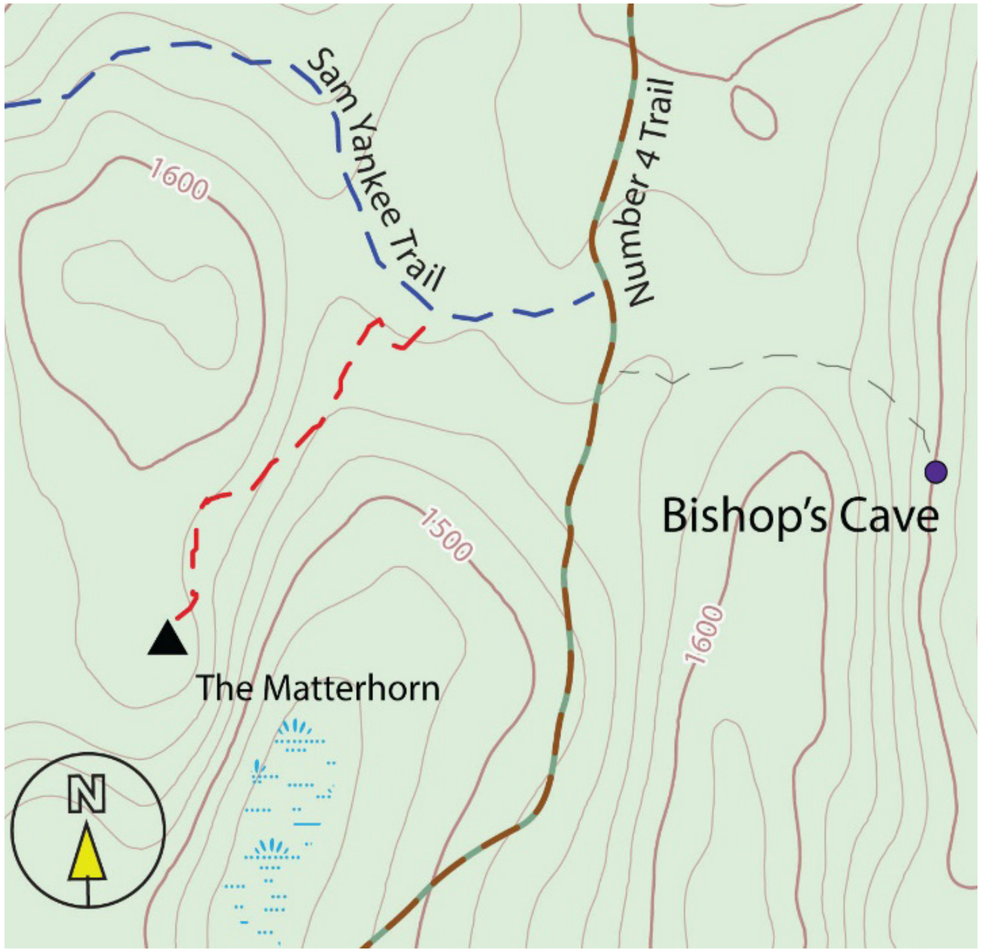
PHYSICAL LANDSCAPE 8: BISHOP'S CAVE

Summary

The site of an old bishop's nature getaway, among giant slabs of fractured metamorphic rock. A great place for the geologically minded to study recently exposed formations.

Access

The cave is most easily accessed by charting a course eastward into the open hemlock forest from the Number 4 Trail. After passing the northernmost point of the Blackberry Hill toe slope, head southward, hugging the ridgeline on your right until you arrive at the cave (see map).



Map of Bishop's Cave in Great Mountain Forest.

The exterior of Bishop's Cave. The surrounding area is filled with giant rock slabs like these, broken off of the main cliff face.

Inside Bishop's Cave. The stacks of firewood are actually American chestnut (Castanea dentada), collected before the blight destroyed all the adult trees in the region a century ago. Chestnut wood is so rot resistant that the logs are preserved to the present day with little sign of decomposition.

This is the top of Bishop's Cave. The ferns growing so prolifically here are rock polyploidy (***Polypodium virginianum***), a species that grows well atop dry exposed rock. They can be found in many similar environments throughout the forest.

Location

Starting point from Number 4 Trail: 41°56'40.30" N; 73°15'5.19" W
Bishop's Cave: 41°56'37.56" N;73°14'53.85" W

Nearby or Comparative Sites

There is a magnificent bald community at the top of Blackberry Hill, just to the south (Natural Communities 3). The trailhead for the Sam Yankee Trail is nearby to the west (Land Use History 11).

Description

This site is named in commemoration of Rev. Robert M. Natch of Springfield, Massachusetts, who dwelt for a time at the Aldridge cabin. Folklore states that the cave was his meditation spot for communion with nature, with bird feeders set up hanging from the jagged rock face to draw creatures close. To this day there are still piles of firewood stacked up inside, and some curious metal sheeting of unknown provenance. The cave itself is not really a cave in the strict sense of the term. The eastern face of the Blackberry Hill toe slope features a sheer cliff of metamorphic rock where

Exposed Quartzite.

large slabs have broken off—one of which happened to land in such a way as to create a modest shelter space. Wandering up and down among the crags of cloven rock, one can find the mineral layers of the metamorphosed rock deposits. These were exposed by the splits in the rock face, and haven't yet had time to erode smoothly away like most of the underlying geology of the Great Mountain Forest. The Bishop's Cave area is thus a fascinating place to study the different types of metamorphic rock of the Forest region. The nooks and crevices of this landscape also provide ideal habitat for many species of mammalian wildlife. Bobcats in particular often make their dens such places. Eroded soil from farther up the hill has begun to fill in many of the cracks, where many trees and shrubs have found places to flourish. Though not novel ecologically, it is nonetheless a beautiful place to scramble around and explore among the sparkling crystalline geologic features.

Research Questions

Survey of the different exposed rock formations.
Survey of wildlife that live in this area.
What is the plant community composition on rock faces and within soil accumulated crags?

Exposed Quartzite.

Exposed schist deposit. The original layers of deposition are still clearly visible.